
BULLETIN

of the

Chicago Herpetological Society



Volume 50, Number 12
December 2015



BULLETIN OF THE CHICAGO HERPETOLOGICAL SOCIETY

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Cover: Western diamond-backed rattlesnakes (*Crotalus atrox*) at the mouth of their winter den in southern Arizona. Photograph by Roger A. Repp.

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The *Bulletin of the Chicago Herpetological Society* (ISSN 0009-3564) is published monthly by the Chicago Herpetological Society, 2430 N. Cannon Drive, Chicago IL 60614. Periodicals postage paid at Chicago IL. **Postmaster:** Send address changes to: Chicago Herpetological Society, Membership Secretary, 2430 N. Cannon Drive, Chicago IL 60614.

River Otter (*Lontra canadensis*) Use of a Gopher Tortoise (*Gopherus polyphemus*) Burrow

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On 8 January 2015, a single adult river otter (*Lontra canadensis*) and several river otter pups were discovered in a gopher tortoise (*Gopherus polyphemus*) burrow on the US Navy's Whitehouse Airfield in Duval County, Florida. The river otters were found during a detector dog survey for eastern indigo snakes (*Drymarchon couperi*). The detector dog became interested in the burrow and gave an indication that did not correspond to a positive or negative find. The burrow was scoped with a burrow camera at the end of the survey to determine the reason for the dog's strange behavior. Several photographs of the adult river otter were taken (Figures 1 and 2).

River otters were not seen in the burrow during a previous survey on 30 December 2014 nor were the river otters seen in the burrow during a subsequent indigo snake detector dog survey on 4 February 2015. A game camera was placed at the entrance of the burrow following the initial discovery of the river otters, but did not take any photographs of river otters. Within the literature, only Lawler (1977) mentions that river otters may be regular or incidental commensals of gopher tortoise burrows. The literature does not mention adult river otters and pups using gopher tortoise burrows nor does the literature mention how frequently river otters use gopher tortoise burrows.

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Lawler, H. 1977. The status of *Drymarchon corais couperi* (Holbrook), the eastern indigo snake, in the southeastern United States. Herpetological Review 8(3):76-79.

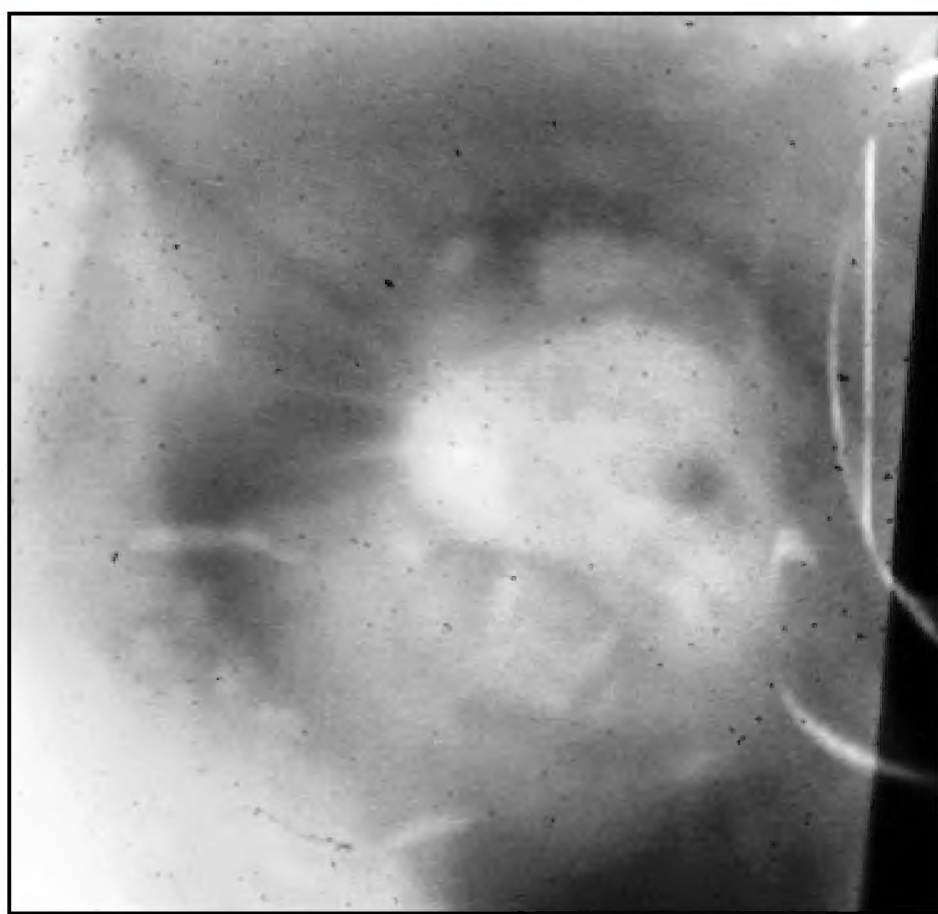


Figure 1. The otter is looking down at the camera with its mouth slightly open. Its canine teeth are visible.

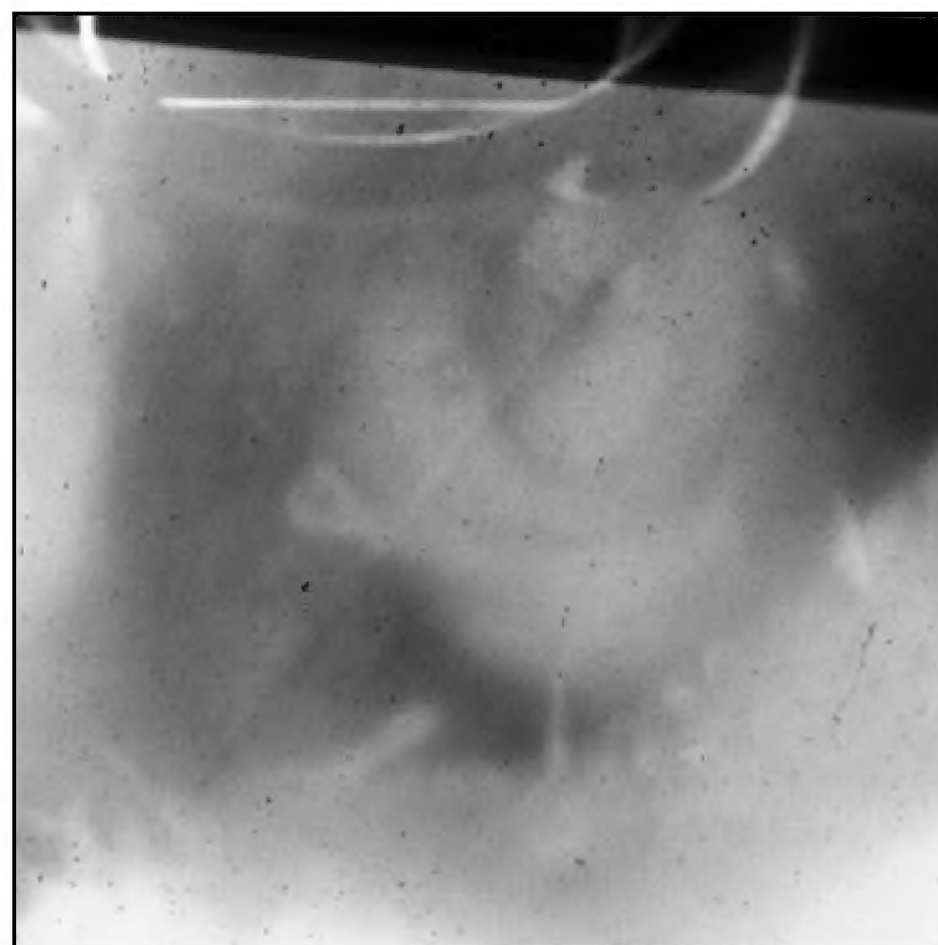


Figure 2. The otter is looking past the camera.

An Accidental Importation of an Afrotropical Anthropophilic Lizard (Squamata: Agamidae: *Agama lebretoni*) into Spain

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On 27 March 2015 a timber shipment from Douala, Cameroon, sent by boat through a harbor of Equatorial Guinea, arrived at the harbor of Valencia in eastern Spain. Valencia harbor staff caught a live lizard among the logs and informed the Reception Centre of Urban Avifauna and Exotic Animals (RCUAEA) of the Municipality of Valencia.

The lizard shows a stout habitus, a snout–vent length of 130 mm, a nostril located on the canthus rostralis, tufts of spiny scales behind tympanum and on the sides of the neck, flank scales homogeneous in size, about 45 vertebral scales between fore- and hind limb insertions, keeled scales under the base of the tail, throat with a reticulated pattern of red-orange lines, and absence of a prominent black spot on the base of the throat (Figures 1 and 2). Based on these morphological and chromatic characters, we identified it as an *Agama lebretoni* Wagner, Barej and Schmitz, 2009. This recently described species is a member of the *Agama agama* complex and is found in southern Nigeria, Cameroon, Equatorial Guinea and Gabon (Wagner, Barej and Schmitz, 2009; Trape et al., 2012). The individual was still alive at the time the present note was submitted and will be preserved in ethanol as a voucher in the RCUAEA.

Members of the *Agama agama* complex show extreme levels of anthropophily and of dietary and ecological plasticity (Pauwels et al., 2004; Delsinne et al., 2015). Their invasive potential is remarkable. Schembri and Schembri (1984) reported the finding in Marsa, Malta, of a live female *Agama agama* amongst beer crates probably imported from North Africa, but no established population is so far known on the island. Specimens of *Agama agama* have been photographed at Antanana-

rivo airport, but the species does not yet seem to have established itself in Madagascar; however it did in Moroni, Grande Comore (Carretero et al., 2005; Wagner, Glaw et al., 2009). *Agama agama* has been introduced in Palermo harbor in Sicily, probably with logs, but it did not establish a population on the Italian island (Lillo, 2008). It has been introduced also to Réunion Island, where it established reproductive populations (Guillermet et al., 1998; Sanchez and Gandar, 2010). Vasconcelos et al. (2009) reported an individual found dead in Porto Novo harbor in Cape Verde Islands, and since then, several populations seem to have established themselves (Vasconcelos et al., 2014). The species has also established populations in Florida (Enge et al., 2004). Some of the pre-2009 reports, i.e., before the description of *Agama lebretoni*, might be attributable to the latter species and should be re-evaluated.

The present note is the first report of an accidental introduction of a member of the *Agama* genus in continental Spain. Valencia is characterized by a semiarid climate with very mild winters (Millán et al., 2005), and it is possible that *Agama* might be able to locally survive. The risks linked to additional introductions of *Agama* in Spain and potential population establishment include competition with and predation on, native species, and transmission of pathogens to native species and humans. Members of the *Agama agama* group are indeed known to be vectors of pathogenic agents (see among others Collard et al., 1957; Enweani et al., 1997; Bêlard et al., 2007). These risks could be limited by increased screening by port authorities, both at the sending and reception harbors, of goods that are potential pathways of introduction of alien species.



Figure 1. Laterodorsal view of an adult *Agama lebretoni* caught at Valencia harbor, Spain. Photograph by V. Sancho.



Figure 2. Ventral view of an adult *Agama lebretoni* caught at Valencia harbor, Spain. Photograph by Juani López.

Acknowledgments

We are grateful to Juani López (Reception Centre of Urban Avifauna and Exotic Animals, Municipality of Valencia) who

kindly informed us about the presence of the *Agama*, and to Mike Dloogatch for his much appreciated editorial support.

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Notes on Reproduction of Pacific Chorus Frogs, *Pseudacris regilla* (Anura: Hylidae),
from Riverside County, California

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Abstract

A histological examination was conducted of gonadal material from 57 Pacific chorus frogs from Riverside County, California. The smallest mature male (sperm in lumina of seminiferous tubules) measured 23 mm SVL and was from October. Two adult males from May with no sperm may suggest a slowing of the testicular cycle in spring. The presence of 8/8 males from September–October with maximum sperm present suggests a renewal of male germ cells occurred in summer. The smallest mature female (mature oocytes) measured 27 mm SVL and was from May. In Riverside County, California *Pseudacris regilla* reaches breeding condition in October and may breed through May.

Pseudacris regilla (Baird and Girard, 1852) ranges from southern British Columbia, Canada, to the tip of Baja California, along the Pacific coast to western Montana and eastern Nevada from sea level to around 3540 m (Stebbins, 2003). *Pseudacris regilla* breeds from January to July in California; females may spawn every other year and may spawn three times in the same year (Stebbins and McGinnis, 2012). Lemm (2006) reported *P. regilla* breeding commenced earlier (November). Dodd (2013) reported breeding begins in January and continues into May in southern California, although most breeding occurs from February to April. Numbers of *P. regilla* do not appear to be declining as seriously as other anurans (Rorabaugh and Lannoo, 2005). In this paper I present data from a histological examination of *P. regilla* gonadal material from Riverside County, California, in which I describe events in the reproductive cycle. Utilization of museum collections to obtain reproductive data avoids removing additional animals from the wild.

A sample of 57 *P. regilla* from Riverside County, California, consisting of 37 adult males (mean snout–vent length, SVL = 28.8 mm ± 3.4 SD, range = 23–35 mm), and 20 adult females (mean snout–vent length = 32.5 mm ± 4.2 SD, range = 24–33 mm) was examined from the herpetology collection of the Natural History Museum of Los Angeles County (LACM), Los Angeles County, California, USA. Examined *Pseudacris regilla* were from 1953 to 1972 and are listed in the appendix.

A small incision was made in the lower part of the abdomen and the left testis was removed from males and the left ovary from females. Gonads were embedded in paraffin, sections were cut at 5 µm and stained with Harris hematoxylin followed by eosin counterstain (Presnell and Schreiber, 1997). Histology slides are deposited in LACM.

The testicular morphology of *P. regilla* is typical of other anurans as described in Ogielska and Bartmanska (2009a). Spermatogenesis occurs in the seminiferous tubules within spherical vesicles (cysts) which remain closed until the late spermatid stage is reached. Cysts then open and differentiating sperm reach the lumina of the seminiferous tubules (Ogielska and Bartmanska, 2009a).

The spermatogenic cycle was divided into two stages (Table

1): (1) “peak sperm production”, maximum quantity of sperm present as cysts, additional cysts in other stages of spermatogenesis also present; (2) “reduced sperm production,” diffuse clusters of sperm free in lumen, few cysts on inner tubule periphery. *Pseudacris regilla* males can breed both in stage 1 and stage 2. The smallest mature male (sperm in lumina of seminiferous tubules) measured 23 mm SVL (LACM 115445) and was from October. Two adult males from May each contained no sperm in the testes (Table 1) which may suggest a slowing of the testicular cycle in spring. The presence of 8/8 males from September–October with maximum sperm present suggests a renewal of male germ cells occurred during summer.

Maintaining spermatozoa throughout the activity season (Table 1) allows for breeding during periods of favorable environmental conditions thereby optimizing reproductive efficiency. The testicular cycle of *P. regilla* most closely fits the “continuous” pattern of Rastogi (1976) which includes those anuran species living in warm zones that are not exposed to harsh winter temperatures with spermatogenesis continuing throughout the year.

The ovaries of *P. regilla* are typical of other anurans in being paired organs lying on the ventral sides of the kidney; in adults they are filled with diplotene oocytes in various stages of development (Ogielska and Bartmanska, 2009b). Mature oocytes are filled with yolk droplets; the layer of surrounding follicular cells is thinly stretched. There were two stages in the spawning cycle of *P. regilla* (Table 2); (1) mature oocytes predominate in the

Table 1. Monthly stages in the testicular cycle of 37 adult *Pseudacris regilla* males from Riverside County, California.

Month	<i>n</i>	Maximum sperm present	Reduced sperm present	No sperm present
February	5	0	5	0
March	6	2	4	0
April	4	1	3	0
May	9	3	4	2
June	5	0	5	0
September	1	1	0	0
October	7	7	0	0

Table 2. Monthly stages in the ovarian cycle of 20 adult *Pseudacris regilla* females from Riverside County, California.

Month	<i>n</i>	Ready to spawn	Not in spawning condition
February	3	3	0
March	3	3	0
April	4	3	1
May	5	4	1
September	1	0	1
October	4	3	1

“ready to spawn category”; (2) in the “not in spawning condition” category, early diplotene oocytes predominate. The smallest mature female (mature oocytes) measured 27 mm SVL (LACM 89710) and was from May. Although my female sample is very small (Table 2), the presence of three females in spawning condition from October may suggest an autumn recrudescence (= recovery) of the ovary. In Riverside County, California *P. regilla* reaches breeding condition in October and may breed through May.

Several atretic follicles were noted in each of two of sixteen (13%) *P. regilla* in “ready to spawn category” and the ovaries of two of four (50%) of females in the “not in spawning condition” category. Atresia is a widespread process seen in the ovaries of all vertebrates (Uribe, 2009) and is described as the spontaneous digestion of a diplotene oocyte by its own hypertrophied and phagocytic follicle cells, which invade the follicle cavity, and eventually degenerate after accumulating dark pigment (Ogielska and Bartmanska, 2009b).

In view of the extensive range of *P. regilla* (Stebbins, 2003), one might expect geographic variation in the timing of reproduction. This has been documented and ranges from November to mid-August (see Dodd, 2013). However, data in Tables 1, 2 indicate *P. regilla* males and females from Riverside County, California reach breeding condition in October, slightly earlier than the date (November) in Lemm (2006).

Acknowledgment

I thank Greg Pauly (LACM) for permission to examine *P. regilla*.

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Appendix

Pseudacris regilla examined from Riverside County, California, borrowed from the herpetology collection of the Natural History Museum of Los Angeles County (LACM). LACM 89635, 89638-89642, 89672, 89675, 89677, 89680, 89681, 89683, 89685, 89690-89692, 89695, 89698, 89700, 89701, 89709-89711, 89715, 89735, 89736, 89763, 91706, 91707, 91914, 91915, 105947-105953, 105955-105958, 105965, 105966, 115429-115433, 115435, 115437, 115440, 115441, 115443-115445, 122029.

**Notes on Mexican Herpetofauna 27:
Defensive Behavior by a Rock Squirrel, *Spermophilus variegatus* (Erxleben, 1777),
toward a Baird's Ratsnake, *Pantherophis bairdi* (Yarrow, in Cope, 1880),
in Parque Ecológico Chipinque, San Pedro Garza García, Nuevo León, Mexico**

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Abstract

Here we document defensive behavior by a rock squirrel, *Spermophilus variegatus*, upon encountering a Baird's ratsnake, *Pantherophis bairdi*. The squirrel may have displayed the behavior because this species represents a potential threat to its offspring. We hypothesize that this behavior in rock squirrels is a previously learned behavior.

Resumen

Aquí documentamos un comportamiento defensivo por parte de *Spermophilus variegatus* (Ardillon) al encontrarse con *Pantherophis bairdi* (Ratonera de Bosque de Pino-Encino) un comportamiento que presenta el Ardillon porque posiblemente esta especie representa un amenaza para sus crías. Entonces hipnotizamos que esto es una aprendido previo.

On 8 May 2015, while inspecting Parque Ecológico Chipinque in the municipality of San Pedro Garza García, Nuevo León, for animal activity, we observed aggressive behavior by a male rock squirrel, *Spermophilus variegatus*, toward a male Baird's ratsnake, *Pantherophis bairdi*. The observation took place at 10:30 A.M., and lasted only 2 minutes before the squirrel noticed our presence and jumped rapidly away. We then moved closer to the snake, which had been severely injured. The squirrel with a single bite had torn out the snake's heart. The snake died 15 minutes later. The snake measured 890 mm snout-vent length, 1113 mm total length, and weighed 150 g. The event took place in area called "La Meseta" almost at the highest part of the park, where many visitors relax after walking about 6 km from the park entrance.

Rock squirrels (*Spermophilus variegatus*)

The rock squirrel has a wide distribution from the central United States of America to the central Mexican Plateau (Hall,

1981), including Nuevo León. It tolerates a wide range of environmental conditions and can be found in pine, oak, xeric, lowland scrub, and riparian vegetation, disturbed areas and cropland, from sea level to 3,600 masl (Ceballos and Galindo, 1984; Hall, 1981; Howell, 1938). In Nuevo León rock squirrels have been observed at 1,200 masl and above (pers. comm., Fernando Gonzalez-Saldivar). They are semi-arboreal ground squirrels. They can reach up to 540 mm in length and weigh up to 817 g. Generally the dorsum is dark-grayish and the venter is white-grayish to brownish. They can become a pest when they are exposed to low numbers of predators. They are extremely social animals, displaying a strong social organization (Johnson, 1981). Depending on their location they can be active during mild winters. In northern Mexico, winters are very cold in the states of Chihuahua and Sonora, but mild in Coahuila and Nuevo León, permitting winter activity. Ortega (1991) documented activity of the species in Arizona where winters may be mild.

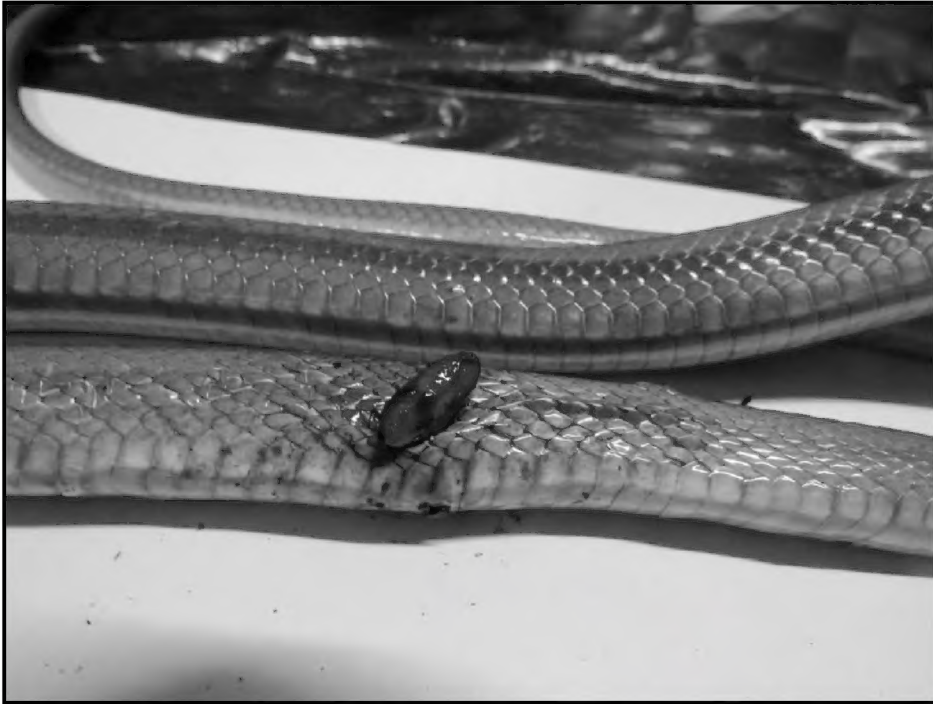
The diet of this squirrel consists basically of plants and



A rock squirrel (*Spermophilus variegatus*) attacking a Baird's ratsnake (*Pantherophis bairdi*). Photograph by Jerónimo A. Chavéz-Cisneros.



The lethally wounded Baird's ratsnake. Photograph by Jerónimo A. Chavéz-Cisneros.



The exposed heart of the male *Pantherophis bairdi*. Photograph by Jerónimo A. Chavéz-Cisneros.

insects; it is an opportunistic feeder consuming a variety of items including nuts, grains, berries, fruit, roots, green vegetation, cactus, small invertebrates and fresh or dry meat material (Bailey, 1932; Burt, 1934; Oaks et al., 1987). Oaks et al. (1987) mention that they can consume animal food items like grasshoppers, beetles, earthworms, young wild turkeys, domestic fowl, and small vertebrates. There is no mention of snakes in their diet.

Rock squirrels are a food item for various species of vertebrates such as coyotes, cougars, badgers, bobcats, crows, hawks, falcons (*Falco mexicanus*), golden eagles and various species of large snakes including *Pituophis melanoleucus*, *Masticophis flagellum*, *Crotalus* spp. (Drabek, 1970; Dunford, 1987; Jaeger, 1961) and *Crotalus totonacus* (Farr et al., 2015). During a herpetological field trip to Canyon de San Isidro, Santiago, Nuevo León, a Red-tailed Hawk (*Buteo jamaicensis*) was observed flying above us with a rock squirrel in its talons (pers. comm., Javier Banda-Leal). More information on *S. variegatus* can be found in Oaks et al. (1987) and Ceballos and Oliva (2005).

Baird's ratsnakes (*Pantherophis bairdi*)

In the U.S. Baird's ratsnakes are found in central and west Texas, including the Big Bend region. In Mexico they are found in central Coahuila, through Nuevo León, to southern Tamaulipas. The species is widely distributed in several physiographical provinces on the Mexican Plateau, with a limited range in the Sierra Madre Oriental, living in a variety of vegetation types present in the region. They inhabit rocky canyons where there are oak and pine forests. They also are occasionally found near urban areas. In particular for Nuevo León we have found them in the municipalities of Galeana, Iturbide, Santiago, San Pedro Garza García and Zaragoza, but they likely occur in many other municipalities throughout the state. We have found them up to 3,000 masl.

Baird's ratsnakes are active diurnally, becoming nocturnal during periods of higher temperatures from April to August. They are slow-moving, and very docile, rarely biting. They usually forage on the ground but can climb shrubs or trees. Their diet consists of small mammals, such as rodents and bats, as well as birds and lizards. Occasionally they climb trees in search of

birds' nests, and have been observed hunting bats at the entrances to caverns (García-Padilla et al., 2011). They are oviparous, laying 3 to 30 eggs in May and June, depending on the size of the female. Approximately 60 days later hatching commences. The hatchlings are ca 365 mm total length.

Baird's ratsnakes show considerable variation in color. Generally the background color is brownish gray with some yellow infused anteriorly. Four dark longitudinal stripes are present, with the two central stripes more prominent. In some specimens the colors are more visible and spectacular than in others. There may be a series of small grayish spots present, reminiscent of the juvenile coloration (juveniles can be confused with juvenile *Pantherophis emoryi*, which also inhabit the park). The belly is lighter than the dorsal region. The top of the head is entirely bluish gray or gray. The ventral scales may show irregular brown spots, sometimes covering almost all the belly. This species can grow to 1530 mm, but this is not the case for most specimens. Schulz (1996) mentions that *Pantherophis* (as *Elaphe*) *bairdi* feeds on rats, mice, bats, birds, bird eggs, and lizards, not giving any specific species.

Historically, Baird's ratsnake was considered a subspecies of the ratsnake *Elaphe obsoleta*, but Olson (1977) documented that they represent a different species. Then Utiger et al. (2002), separated the genus *Pantherophis* from *Elaphe*. The species does not have protected status in Mexico.

More information on this species in Mexico can be found in Lemos-Espinal and Smith (2007) and Lazcano-Villareal et al., (2010).

Another type of mammalian defensive behavior against snakes

Many organisms, representing a wide array of taxa, directly apply foreign substances onto their integument, an activity called self-application or anointment (Weldon, 2004); these substances can act to repel predators (Kobayashi and Watanabe, 1986; Xu et al., 1995; Weldon et al., 2003; Weldon, 2004; Carroll et al., 2005). Such behavior has been documented by many herpetologists. For example Clucas et al. (2008) mention squirrels chewing rattlesnake sheds and applying the resulting mixture to their own fur or to the fur of related individuals. This is thought to act as a defense against rattlesnake predation. They studied this in two species of squirrels, *Spermophilus beecheyi* (California ground squirrel), and *S. variegatus* (rock squirrel). In addition, adult females actively protect their offspring from rattlesnakes (Swaigood et al., 2003). In Parque Ecológico Chipinque there are two large rattlesnake species, *Crotalus atrox* (western diamond-backed rattlesnake) and *C. molossus* (black-tailed rattlesnake), that could prey on the offspring of the rock squirrels or even on the adults.

In this case the behavior exhibited by the rock squirrel might have been prompted by a previous experience with a snake. Various other species of rodents also exhibit defensive behaviors toward snakes (Xu et al., 1995; Owings and Coss, 1977).

Acknowledgments

We would like to thank the multiple national and international institutions that supplied the necessary literature to sup-

port the manuscript. We thank the Universidad Autónoma de Nuevo León and Parque Ecológico Chipinque A. C. for allowing us to conduct various studies in the field and laboratory. We

also thank all the persons who have participated in the field and laboratory work with us.

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**Book Review: *Amphibian Survey and Monitoring Handbook* by John W. Wilkinson
2015. 120 pp. Pelagic Publishing, Exeter, United Kingdom
Hardcover £59.99 ISBN: 978-1-78427-004-9 / Softcover £29.99 ISBN: 978-1-78427-003-2**

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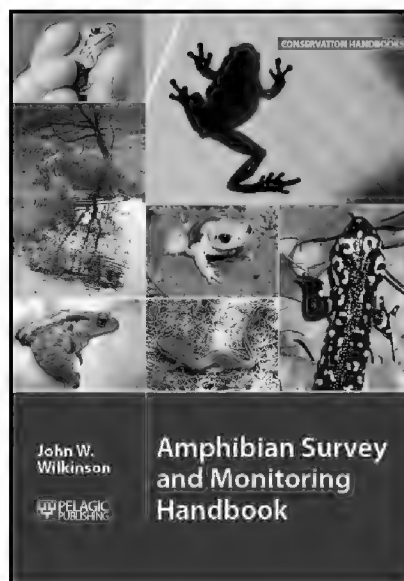
This and many other books and products are available at Amazon.com. If you go to AmazonSmile and designate the Chicago Herpetological Society as the charity you wish to benefit, then any purchases you make will help to support the CHS.

With the publication of *Amphibian Survey and Monitoring Handbook*, I am reminded of the quote attributed to famed major league baseball personality, Yogi Berra, “It’s déjà vu all over again.” Two books with similar titles precede this latest offering from Pelagic Press. The first, *Measuring and Monitoring Biological Diversity: Standard Methods for Amphibians* (Heyer et al., 1994), was published by Smithsonian Institution Press. This was followed by *Amphibian Ecology and Conservation: A Handbook of Techniques* (Dodd, 2009), published by Oxford University Press. How does this most recent amphibian surveying and monitoring book compare to previous titles? Let’s find out.

Unlike the first two amphibian surveying and monitoring books, which are compilations of chapters written by numerous experts, *Amphibian Survey and Monitoring Handbook* was written by a single author, John Wilkinson. Wilkinson is a biologist with Amphibian and Reptile Conservation Trust, based in the United Kingdom. As I read Wilkinson’s book I was struck by two things: 1) Wilkinson is a first-rate writer and 2) his considerable experience surveying amphibians in the United Kingdom is conveyed throughout the entire text. This is obviously a man who has spent a lot of time planning, conducting, and summarizing the results of amphibian surveys.

Like the above-mentioned earlier works, *Amphibian Survey and Monitoring Handbook* is well organized. All three books start out by introducing the three orders of amphibians: caecilians, frogs, and salamanders. Wilkinson organizes the remainder of his book into the following four chapters arranged in a logical, cookbook-like fashion: Chapter 2: “Before you start surveying,” Chapter 3: “During your survey: amphibian survey methods,” Chapter 4: “After your survey,” and Chapter 5: “Resources to help you.” He takes a straightforward, here’s-how-you-do-it approach. Although not explicitly stated, it appears that Wilkinson’s book is written with the novice in mind.

In Chapter 2, “Before you start surveying,” Wilkinson notes that every survey should seek to answer a question. Doing so dictates what type of survey will be conducted and what methodology will be employed. A one-time species presence-absence survey, for example, differs greatly from one designed to detect population trends over time. I applaud Wilkinson’s suggestion that the reader peruse the published literature to find “what has worked before.” In this vein, I have relied heavily on those who have come before me. No need to re-invent the wheel. He also



stresses the importance of developing field data forms (examples of which are provided in Chapter 5). Having produced my own field data sheets for a variety of projects over the years, I can attest to their value.

In a subsection entitled “Health and safety, and biosecurity” Wilkinson introduces the use of latex, vinyl, and nitrile gloves when handling amphibians. He does not, however, mention a report of glove toxicity to larval amphibians (Cashins et al., 2008). I think a precautionary note regarding gloves should have been included.

Wilkinson includes advice on how to handle amphibians because he has met people planning to conduct surveys “who have never actually held a frog.” He recommends crouching or kneeling when holding an amphibian so the amphibian will not “panic” and feel as if “in the sky.” I doubt amphibians have a fear of heights. Numerous species are arboreal and a number of terrestrial species climb into vegetation to feed, escape predators, or to orient themselves. I have watched non-climbing amphibians, such as ranid frogs, leap off high (>1 m) wetland banks into the water, seemingly oblivious to the height from which they leapt. I don’t believe handling an amphibian while standing is any more stressful to an amphibian than when crouched or kneeling.

Chapter 3, “During your survey: amphibian survey methods,” comprises the bulk of the book. It is divided into two main sections, “Surveys of aquatic habitats” and “Surveys of terrestrial habitats.” At the beginning of each section, Wilkinson recommends becoming familiar with the study area by making at least one preliminary visit. This is especially important if one will be conducting nocturnal surveys.

As one might expect with an amphibian-survey book, the aquatic survey section is longer than the terrestrial section. Techniques emphasized include visual surveys (both day and night), dip-netting, and trapping. Throughout the book, Wilkinson refers to a flashlight as a “torch,” conjuring up an image in my mind’s eye of the author standing at the edge of a wetland at night, flaming wood-torch in hand. He correctly notes that aquatic funnel traps have been “invented independently many times over.” Humans are forever on a quest to build a better mousetrap or, in this case, amphibian trap. Wilkinson mentions commercially available traps as well as homemade alternatives. He especially likes traps made by cutting off the

tapered end of a 2-liter plastic drink bottle and then inverting it back into the body of the bottle. I find such simple traps very useful for capturing cave crickets in my basement. I appreciate the author's emphasis on maximizing survival of trapped animals by 1) clearly marking or mapping the location of each trap so that none are missed and left behind, and 2) ensuring sufficient air space within each trap to reduce the likelihood of drowning air-breathing animals. He also mentions "light baiting," a technique used to potentially increase captures by placing glow-sticks into traps set overnight. I can attest to their efficacy for some amphibian species.

In the terrestrial survey section, Wilkinson introduces the reader to distance- and time-constrained visual encounter surveys, terrestrial plots, artificial refugia, pitfall trapping along drift fences, and aural frog-call surveys. You may be wondering, as I did, why frog-call surveys are in the terrestrial survey section. Wilkinson explains this decision by stating that, although such surveys are conducted "at or around breeding sites" call surveys "do not require aquatic survey equipment."

As with aquatic trapping, Wilkinson emphasizes animal welfare when pitfall trapping. He stresses the importance of providing moist sponges to prevent desiccation of trapped animals, as well as polystyrene floats to prevent drowning should pitfalls fill with water. Whether trapping aquatically or terrestrially, my goal is 100% survivorship of trapped animals. Unfortunately, due to circumstances beyond control (e.g., the simultaneous detention of an amphibian with a hungry predator), this goal is rarely achieved. Nonetheless, I agree with the author that every effort should be made to prevent "needless suffering or death" of trapped animals. I was surprised that Wilkinson did not mention funnel traps as an alternative to pitfall traps. Well-constructed and well-placed funnel traps can be far superior to pitfall traps for capturing a variety of amphibian species (Enge, 2002; Todd et al., 2007). They are especially useful at locations having a high water table or prone to flooding, both of which can reduce the effectiveness of pitfall traps.

In the final pages of the chapter, Wilkinson advises the reader on collection of habitat and environmental data, and he provides tables of variables the surveyor should consider measuring. He points out that such data are critical when interpreting observations and are useful for those conducting follow-up surveys. He notes, too, that collecting additional data can be used "to demonstrate that you carried out your survey under

appropriate conditions." He mentions "unscrupulous developers or even ecological consultants" who inappropriately determine presence or absence of particular species by surveying at the wrong time of year. Here in the States, we call consultants who put personal wealth above good science "biostitutes."

Chapter 4, "After your survey," is all about what to do with the data you've collected. Wilkinson provides examples of arranging data in spreadsheets for statistical analyses and provides titles of useful statistical books and software. He also provides advice regarding report writing, emphasizing that the report should be well-organized, similar to a peer-reviewed journal manuscript. Wilkinson's inclusion of a report-preparation section sets his book apart from its predecessors. He finishes this chapter by providing cursory introductions to additional amphibian studies one could undertake such as mark and recapture population studies, radio-telemetry studies to determine movement patterns and habitat selection, landscape (Geographic Information Systems) studies to quantify available habitat, and taxonomic studies.

In Chapter 5, "Resources to help you," Wilkinson provides examples of data sheets, names herpetofaunal field guides from around the globe, lists potentially useful textbooks (Heyer et al., 1994, is cited here), gives a list of websites for equipment suppliers (there are many more than listed), and provides a list of "amphibian study and conservation organizations and societies." Notably absent is Herpetologists' League. I think mentioning the "Techniques" section of *Herpetological Review* would have been useful to the reader.

Although I do find the succinctness and the one-author format of *Amphibian Survey and Monitoring Handbook* appealing, it falls short of its longer, multi-authored predecessors, both of which go into greater detail on the many facets of amphibian sampling. However, if you are in the British Isles or are looking for a beginner's guide to amphibian survey techniques, *Amphibian Survey and Monitoring Handbook* is definitely a good place to start. I do, however, recommend that neophytes also refer to the two aforementioned amphibian surveying and monitoring books, as well as the peer-reviewed literature.

Acknowledgments

I thank Mike Dloogatch for the opportunity to review this book and Alessandro Catenazzi for access to the library in the Southern Illinois University at Carbondale herpetology laboratory.

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Bowling for Diamondbacks

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At the date of this writing, with the help of many friends, this author has located 53 different winter denning aggregates of Western Diamond-backed Rattlesnakes (*Crotalus atrox*) in southern Arizona. (The easiest way to proceed with this narrative is to simply call the snakes under discussion “atrox”). By definition, a denning aggregate, or communal den, must have a minimum of two or more animals utilizing it. Hence, the numbers of atrox that have been viewed in these communal dens range anywhere from two to 21 individuals. Of all 53 dens that have been under observation, there is one den that towers above all the others in terms of being fun to watch. We speak of Ron’s Den.

Ron’s Den was named after my work colleague and friend Ron Harris. Ron is a dyed-in-the-wool hunter and outdoorsman. In February of 1995, Ron described finding a place that “had 30 rattlesnakes” basking in snarls outside of a gash-like opening. Further inquiries led to some very rough directions on how to find the place. (These were the days before everybody had a GPS unit, and Google Earth wasn’t even a gleam in anybody’s mind). We were to drive a certain distance down a dirt road, and look for a bunch of splattered potatoes. The short story is that Ron and friends had potato cannons, and put them to good use during the drunken revelry that follows a long day of hunting.

We found the place without any difficulty, as the whole area was merrily peppered with detonated spud offal, and many of the nearby tree branches were gaily festooned with shredded strands of russet dingleberries. It must have been a bad night to be a potato. Once the potato graveyard was found, we were to take a compass bearing of 338° northwest, and hoof two miles over hill and dale, while seeking a lone but massive Saguaro. Once the Saguaro was found, we were to turn right, and go about 100 meters eastward, looking for rocks that looked like cement. According to Ron, those cement-like rocks were the place.

On 16 March 1995, off five of us went. We found the Saguaro, turned right, but found nothing that looked like cement within 100 meters of said Saguaro. But way off in the distance, we saw some formations that were cement-like in color. We walked about a mile-and-a-half to these cement-like rocks, and found a boatload of atrox. When I relayed the tale back to Ron, his countenance clouded up with verklempt consternation. He told me that he would get back to me momentarily, and he did. We were supposed to turn *left* at the saguaro, not right. He was all sorts of apologetic about it. But seeing how his errant instructions had led us to a new atrox Shangri La, I wasn’t even a little bit peeved. (The people who were with me on 16 March were Don Swann, Dennis Caldwell, Daniel Bell, and Patti Mahaney. As a result of the misinformation Ron had provided, we discovered two excellent dens that continue to thrive to this very day. One of these dens was named “3DPR” after the first names of the members of our party. The second was named “Fluorite Mine,” simply because it was one. Both of these dens

have already been mentioned in a recent edition of the *Bulletin*. The atrox there have been known to drink snow).

On 19 March 1995, Erik Enderson, Pat Collins and I gathered at spud central. We headed out on the same compass bearing as before. Only this time, we did not actually see the Saguaro until we had gone well past it. On our return trip, while still seeking the Saguaro, I slipped around the east side of a wash embankment, and on rounding the corner, saw a few scattered atrox spread across a three-meter-long east-to-west, south-facing gash. The rocks above it looked exactly like cement. Bingo! We had it! It was then noted that we were standing roughly 100 meters “to the left” of a very large Saguaro, further confirming that we were in the right spot.

But our main mission on this day was to observe and photograph mating atrox. The previous year, in other places, we had seen March mating. But nobody would believe us! Today, we were going all out to *prove* that they mate in the spring. (This clearly demonstrates how far the general knowledge of southern Arizona’s most common viper has come over the past 20 years. We now know that they routinely mate in the spring). Our first look at our new gash den revealed a cluster of three atrox at the east entrance, and a few more scattered coiled flush with the edge along the length of it. These were all large, adult males. The biggest of the three in the cluster was a light-colored rascal, and he reacted to our presence more out of curiosity than malice. He shifted out of the pile, slipped toward us, and then coiled again, watching us very closely. We kept our distance, shined mirrors into the depths of the maw behind them all, and saw many more coils inside. We decided that the mating wasn’t happening here—yet. We would come back later that day to check again.

My confusion with the first visit allowed for a more thorough knowledge of the terrain, and the roads that led through it. Hence, I knew that if we followed the wash to the right of the Saguaro, it would lead us to a barbwire fence. And running along the opposite side of the fence was a road. And that road intersected the road on which the potato graveyard resided. There would no longer be any need for blundering through undulating terrain while staring at a compass with future visits to Ron’s Den. From this day forth, we could simply drive, park, and take a leisurely stroll to get there.

The remainder of this day was highly productive in terms of what we were seeking. We headed off to 3DPR and the Fluorite Den, where we were able to photograph multiple pairs of atrox in courtship, and two incidences of all out mating. There were to be some generous servings of crow to be offered up in the days ahead. As crow is my personal favorite dish to prepare, I saw to it that it was consumed with maximum pain by those to whom it was served. The aftertaste lasted for years!

We utilized our newfound route to return to Ron’s Den that day. But our approach was different. This time, we would be



Figure 1. 19 March 1995. From 30 meters away, the atrox in this image saw us coming, broke coil, and crawled leisurely across the front of Ron's Den. Why didn't he just crawl into the opening? All images by the author, see text for details.

moving straight toward the front door. We rounded a wash bend, and as we did, we were highly exposed for over 50 meters between us and the den. Anything around or in Ron's Den could likely see us from that distance. "Warning! Three big blobs approaching from the south!" At 30 meters away, the large, light-colored atrox that had been noticed earlier that morning broke ranks from his coil spot. He slowly crawled across the entire expanse of the three-meter-long gash (Figure 1), and leisurely settled on top of several other atrox. None of the snakes moved from that point on. Nobody freaked out, nobody rattled, nobody got all excited. We continued toward the den with very slow, measured, and careful strides. We got to within three meters of them, and I took the image in Figure 2. They were just watching us, even when we continued to circle and photograph them (Figure 3). Not a one of them moved a muscle! We quietly left them as found.

Without realizing it, we had just experienced our first look at the alpha male of Ron's Den. He would one day earn the name of "Tyson" from a National Geographic film crew. Tyson's performance with the incident just described was minor compared with what was to come in the years ahead. This author fully understands that behaviors witnessed in the wild and reported



Figure 2. The atrox then settled on top of a cluster of denmates. All action then froze as we circled around to photograph from another angle. The snake on top of the pile was later named "Tyson," and this remains the very best image of Tyson that I have.

with any form of explanation as to why it might have happened the way it did is to set up the dreaded word "interpretation." However, if we are not allowed to interpret, or speculate, on what might have happened here, how will we ever begin to understand the mind of a snake?

For too many centuries, even among those who know them best, snakes have been regarded as wind-up toys that emerge from the womb pre-programmed by instinct to react to certain situations based on their inner physiological cues. There is no allowance for learned behaviors, or any form of empathy, or any sort of human emotions such as love, hate, anger, or even fear. To even suggest that such things *may* exist among them is to bring on relentless ridicule from the very people who should be trained, just a little bit, to keep their minds open. I often hear variants of the following statement: "You can't *prove* that this is what is really happening, and it ain't science until you can prove it!" It is exactly this kind of thinking that makes it impossible to ever get past the hurdle of elevating snakes in general, and rattlesnakes specifically, beyond the centuries-old enigmatic dogma that surrounds them.

No, I can't prove any statements that follow in this paragraph. But as this is still a free country, I can interpret what we saw here, and leave the reader to draw their own conclusion. Tyson saw us coming from a long way off. He broke out of his coil, and crawled a distance of over three meters to put himself on top of a pile of other atrox. For that entire distance, there was a wide open gash that he could have dived into, and completely disappeared from sight. That would seem to be the safest option, if self-preservation was the driving force behind his actions. No! What he did here was place himself between us and his denmates. The message I walked away with was that he deliberately put himself there as an indication of "If you want them, you have to go through me first!" It was a smashing first impression, but the best was yet to come from Tyson.

Before getting too involved with why Ron's Den has been to date the best den for watching social behaviors, a physical description of the place is in order. As previously suggested, it is a gash den. The gash-like opening is roughly 30 cm (~12 inches) tall in the center, and faces due south. The cement-like slab that is above the gash is a mixture of conglomerate limestone and



Figure 3. Another angle of Tyson on top of denmates. Note that despite the three circling quadrupeds, none of the snakes panicked and shot into the safety of the den opening.



Figure 4. 12 March 1998. A gathering of *atrox* at the east entrance to Ron's Den. As usual, Tyson presides over the gathering.

caliche, and provides a sheltering overhang across the three-meter-long east-to-west expanse. There is a wedge-like pillar of conglomerate rock that likely serves to support the overhanging ledge on the east side of the gash. This wedge is roughly one meter wide, and tapers inward for about two meters deep. On the east side of this wedge is a much larger opening, perhaps one meter in diameter, and it goes deep. The gash to the west meets the hole to the east at the deepest penetration of the wedge. Hence, the two chambers are connected. There are a few scraggly Catclaw and White Thorn Acacia trees peppered at the southeast and southwest side of the den. But the den itself is nearly 100% on an open, gradual slope, and gathers sun from dawn to dusk. If we might be permitted to think in similar fashion to a top of the line predatory ectotherm like *Crotalus atrox*, we might think "Hot outside, cool inside, and a thermal Disneyland anywhere in between it all." If that was all that Ron's Den was, it would be enough.

But, no! Ron's Den has more than thermoregulatory perfection going for it. First off, out of 53 total *atrox* dens, none of them have (or had) Tyson. He was mean and lean, and big and bad, and he ruled his roost like a tyrant. Nothing happened there that Tyson didn't know about. He was on constant patrol, and stuck his nose into everything. So, Ron's Den had Tyson—but wait! There's more! Twenty more, to be exact. On one occasion, I counted 21 *atrox* around and in the den. The most I've ever seen at any other *atrox* den is 17. Stuffed inside the incredibly deep maw of the gash is possibly several centuries worth of Pack Rat (*Neotoma albigula*) detritus. That is because a rat, or rats, overwinter with the *atrox*. And last, but certainly not least, a very large Sonoran Desert Tortoise (*Gopherus morafkai*) was often viewed in the depths of the east side of the den. It is always difficult to estimate size when looking two meters deep into the maw of a cholla and stick infested hole, but I could tell that this boxcar of a tortoise may very well be the biggest that I have ever seen. If my deep hole estimates are to be believed, this tortoise was over 350mm (14 inches) MCL (Mean Carapace Length). He was a big one for sure!

I surrendered Ron's Den to a film crew in March of 1996. They were filming for a National Geographic special called "The Sonoran Desert, A Violent Eden." When they were done with the filming, they had me take a look at what they had captured

on film, just prior to the final cut. In all, I witnessed a half-hour of high quality cinematography that caught some of the most jaw-dropping rattlesnake social behavior sequences that I have ever seen. Through it all, Tyson's performance was magnificent. Some of what was captured made our initial mate-guarding observation pale by comparison. At the end of the viewing, the producer of the film, Sean Morris, had this to say about his week-long stay at Ron's Den: "I never could have imagined what delightful creatures rattlesnakes are."

After my viewing, they pared the film down to but a few sequences for the actual production. The best of what they got wound up on the cutting room floor. But my half-hour viewing of what had taken them a week to get taught me many new things to look for. And for the next several years, my visits to Ron's Den intensified.

A very wet and cold El Niño weather system began in fall 1997, and continued all the way through 1998. This extremely wet weather system set up a very leisurely egress period for the *atrox* at Ron's Den. Upon visiting the den on 12 March 1998, I found some snarls of *atrox* coiled just outside the east entrance of the den. Perched on top of them all was the always-present Tyson, who was doing his best to maintain a high profile with the cluster. (Figure 4). On 20 March, the snarls were viewed as one big pile, still at the east entrance, with Tyson on top, digging with his tail down into the pile. He was obviously blindly searching for something to hook his groping appendage around.

On 22 March, I was back for more. As I rounded the bend and Ron's Den came into view, I noted that the massive tortoise was completely out of the den, roughly 10 meters downslope from the east entrance. I had been visiting Ron's Den for just over three years now, and this was the first (and only) time that I had seen him out! Talk about excitement! He was every bit that 450 mm MCL that I had estimated, maybe more. What a *dandy*!

But, as suggested earlier in this narrative, what you see when you round the wash bend and view Ron's Den can also see you. From 50 meters away, that tortoise saw me, and briskly turned to lumber back toward the den. But he wasn't the only one on the move. While I sprinted toward the now retreating hindquarters of the brute, I was unzipping my camera pack and pulling my camera out. I wanted a picture of this brute! My adrenaline was high, and I was a much younger man at the time. I covered the ground between us in jig time.

I got to within five meters of the rapidly retreating tortoise just in time to note that the pile of *atrox* that had been in front of the east entrance since 12 March were still there. And that tortoise was heading straight toward them, moving as fast as a tortoise can move. Sure enough, without breaking stride, the tortoise barreled right through the center of them. Wham! Snakes flew *everywhere*, and a brief symphony of a dozen snakes hissing and rattling filled the air. The action was exactly like watching a perfect strike at a bowling tournament. In much same way the bowling pins fly all around and collide with each other, the same thing was happening with the snakes. Another favorable comparison is one of those joke cans from which, upon being opened, a bunch of snakes come flying out. Tyson was the first to collect his wits, and ascended into a combat

stance. “Click” went my camera (Figure 5)—a few seconds too late to actually catch the collision, not to mention the tortoise, who was well inside Ron’s Den by this point. I was too busy gawking at that tortoise’s perfectly bowled strike to get an image. It’s just as well, it would have been a blurry and crappy photo anyhow.

Almost as amazing as the event just described was is how quickly it was over. Tyson remained suspended half a body length in the air for about 20 seconds. He then dropped, and began nosing around the area, gathering his flock. Everybody assumed their positions again. Within five minutes of the bedlam, it was if nothing whatsoever had happened at all. All was once again peace and harmony with the atrox at Ron’s Den.

Mr. Morris was quite right. They *are* delightful creatures.

This here is Roger Repp, signing off from southern Arizona, where the turtles are strong, the snakes are handsome, and the lizards are all above average.



Figure 5. 22 March 1998. Tyson’s reaction to a large adult tortoise plowing through his love nest. Note that one other atrox is still freaking out, and blazing across the trail created by the fast-moving tortoise.

What You Missed at the November Meeting

John Archer
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Gavin Brink started his talk at our November meeting by denying he was a herpetologist. I suppose that he really wanted to say that he was not a professional herpetologist, but if one defines a herpetologist as one who studies reptiles and amphibians, Gavin Brink is a herpetologist. He doesn't make a living at it, but I know he has studied biology, chemistry, and husbandry related to reptiles and amphibians, keeping and breeding these animals as well as studying them in the field, particularly in Central and South America. I think he was trying to hedge his bets because his talk would present more questions than answers and was not based on original research. But we learned nevertheless. He titled his talk "Poisonous Snakes. How Many Are There? How Do They Work? What is the Most Poisonous?"

I admit that I had fun publicizing his talk because of the poisonous snake angle. I figured that most of our members would know of *Rhabdophis tigrinus*, the tiger keelback of Asia, maybe the most famous poisonous snake described, but those folks would not be fully versed in the possibilities of other poisonous snakes, and I especially enjoyed arousing the curiosity of those that tried to correct me to use venomous. I like stirring others' curiosity as much as I like having mine stimulated.

Gavin had previously written an article on the subject for the *Bulletin* [Bull. Chicago Herp. Soc. 50(8):117-124, 2015] and I was excited to have him in person. He has an extensive list of references with that article and I encourage anyone who is interested in poisonous snakes to read it. Gavin gives an excellent overview of the topic.

He started with a slide showing the following definitions, based on Nelsen et al. (2014):

Venom: a toxic substance (comprised of one or more toxins) causing dose-dependent physiological injury that is passively or actively transferred from one organism to the internal milieu of another organism via a delivery mechanism and mechanical injury.

Poison: a toxic substance (comprised of one or more toxins) causing dose-dependent physiological injury that results in self-induced toxicity (e.g., bacterial endotoxins) or is passively transferred without a delivery mechanism from one organism to the internal milieu of another organism without mechanical injury, usually through ingestion, inhalation, or absorption across the body surface.

Toxungen: a toxic substance (comprised of one or more toxins) causing dose-dependent physiological injury that is actively



Gavin Brink. Photograph by Dick Buchholz.

transferred via a delivery mechanism from one organism to the external surface of another organism without mechanical injury.

Gavin made the point that anything in sufficient quantities can be toxic and felt that these definitions managed to successfully categorize the various toxins. He next wanted to take us from "high school chemistry to organic chemistry in about five minutes." Yeah, right. High school was a long time ago for some of us.

But Gavin talked about physicists being interested in the nucleus of atoms while chemists are interested in the electron cloud, specifically the outer shell of electrons (I appreciated that because it had never occurred to me), how the periodic table reveals properties of elements, and how the carbon atom is the basis of life and what organic chemistry is all about. He covered protein folding and amino acid sequences, large molecules and small, hydroxyls and alcohol, and how all of this has an effect on toxins. He didn't make me conversant in organic chemistry, but he gave me something that allowed me to understand a bit about how toxins perform.

We next saw slides of *R. tigrinus* with its red neck advertising its sequestered poison. Gavin spoke about the change in the *Bufo* toxins that occur when sequestered in the snake and showed cool photos of the glands that held the poison. The snake can actually expel the poison up to a meter. Gavin said that all *Rhabdophis* may not be poisonous but most probably are. It's been documented that some female *Rhabdophis* will consume more toads prior to laying eggs in order to equip their young with greater quantities of toxin.

We moved on to other genera that are poisonous, including uncommon snakes in the genera *Balanophis* and *Macropisthodon*, nearly all species of which have nuchal glands that can



This defensive posture of *Rhabdophis tigrinus* prominently displays its bright red neck. Photograph by Max Ryan.



The nuchal glands of *Rhabdophis tigrinus* exposed. Photograph by Kevin Messenger.

sequester toxins and also usually have brightly colored necks. *Macropisthodon rudis*, the one species of its genus that does not have the nuchal glands also does not have the bright warning colors. Gavin thought that was more than just coincidence.

Gavin pointed out that all poisonous snakes do not have nuchal glands. *Thamnophis* spp. have long had an arms race with *Taricha granulosa* on the west coast, developing tolerance to the newts' toxin, and in the process becoming poisonous themselves. It seems that the snakes sequester the toxin in their livers and can be lethal to consume for a bird for up to a month after eating just one newt. Gavin had slides of brightly colored *T. sirtalis* within the newts' range and less colorful photos of the same species living outside of that range and speculated that the less colorful was unlikely to be significantly poisonous, though that has not been studied.

Gavin mentioned the anthropomorphically caused poisonous snakes. We're releasing so many pollutants such as mercury and pesticides into the environment that wild animals near the top of the food chain are sequestering those toxins and become deadly to consume. Cottonmouths, watersnakes, and Burmese pythons are sequestering enough of these pollutants throughout their bodies that they are definitely unsafe to consume, if not outright poisonous. He mentioned a study that showed a population of juvenile cottonmouths that consumed salamanders almost exclusively. Whether that makes them poisonous has not been explored, but Gavin did point out that they undergo an ontogenetic color change from a fairly bright color to the relatively subtle colors of the adult. Perhaps the coloring of the juveniles acts as a warning that they are poisonous?

Other species might be poisonous but we just do not have the studies to confirm that. Snakes in the genus *Thamnophis*, snakes in *Liophis*, and even *Heterodon* may yield interesting results with the proper data collected. As in so much of biology, funds and time are always in short supply.

Gavin wanted to give an introduction to poisonous snakes, have a little fun with some speculating, and, like many good instructors, leave us with more questions than answers. Looking for an area to explore for a thesis? Or maybe just because you're curious? He's given us some interesting facts to mull and a good basis for more research into the world of poisonous snakes. We may one day be in the same place we recently find ourselves with venomous snakes—a plethora of poisonous snakes. Interesting stuff this biological science, especially in herpetology. I can't wait to see what's next.

Literature Cited

Nelsen, D. R., Z. Nisani, A. M. Cooper, G. A. Fox, E. C. K. Gren, A. G. Corbit and W. K. Hayes. 2014. Poisons, toxins, and venoms: Redefining and classifying toxic biological secretions and the organisms that employ them. *Biological Reviews* 89(2):450-465.

Herpetology 2015

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

ARBOREAL BEHAVIOR IN COTTONMOUTHS

J. G. Palis [2015, Transactions of the Illinois State Academy of Science (108):39-42] notes that cottonmouths (*Agkistrodon piscivorus*) are relatively wide-ranging, North American semi-aquatic pit vipers that frequent edges of water bodies. Although numerous literature accounts describe cottonmouths basking in trees and shrubs at the water's edge, a recent quantitative study in Alabama and Georgia suggests that arboreal behavior by cottonmouths is actually very rare (0.25% of 804 observations). In contrast, the author observed frequent arboreal behavior by cottonmouths (42% of 1534 observations) during spring and fall at a southern Illinois wetland. Arboreal basking was particularly frequent in spring (57% of 1049 observations). Frequency of arboreal behavior did not differ between adult and juvenile cottonmouths, but juveniles perched higher than adults. These observations indicate that cottonmouths may frequently be arboreal, at least near the northern limit of their geographic range. Arboreal behavior might facilitate thermoregulation and/or predator avoidance.

CHANGES IN WESTERN POND TURTLE POPULATIONS

D. T. Ashhton et al. [2015, Copeia 103(3):621-633] note that water diversions can disrupt flows and alter thermal regimes changing seasonal patterns that signal the onset of life-history functions of native organisms and compromise the fitness of their populations. The authors compared size, growth, relative mass, volumetric body condition, and reproductive status of western pond turtles (*Actinemys marmorata*) across a decade on two forks of California's Trinity River, one regulated and the other free-flowing. Turtles on the regulated fork experienced flows designed to accommodate anthropocentric demands, whereas those on the free-flowing fork experienced natural hydrologic cycles and seasonal warming. July water temperatures averaged 8.6°C colder on the regulated fork due to hypolimnetic releases. Turtles on the colder regulated fork grew more slowly and were smaller at similar ages compared with those on the free-flowing fork, a pattern that was exacerbated across the decade. Female relative mass (RM) across the decade did not differ between forks, whereas male RM was greater on the free-flowing fork only in the 1990s. In the 2000s volumetric body condition of females on the regulated fork differed significantly from males on both forks and females on the free-flowing fork. Females on the regulated fork appeared to be assimilating more resources possibly in response to colder water. Fewer females on the regulated fork were gravid and, due to smaller size, likely carried fewer eggs. The percent of gravid females on both forks declined significantly across the decade. The authors found additional evidence of a wider regional effect with differences in RM shifting from positive to negative for both sexes on both forks. They did not collect evidence that would explain these phenomena but these changes strongly suggest that trophic relationships of the turtles in the greater region are being adversely influenced.

PRIMATES VERSUS BOA

C. J. Gardner et al. [2015, Primates 56(2):127-129] note that the interactions between primates and their snake predators are of interest because snakes have influenced the evolution of primate visual systems and predation has driven the evolution of primate behavior, including group living. However, there are few accounts of primate-snake interactions in the wild. The authors report an incident from northwest Madagascar in which a large female Madagascar ground boa (*Acrantophis madagascariensis*) captured an adult female Coquerel's sifaka (*Propithecus coquereli*); upon capture, the prey's group members proceeded to bite and scratch the snake until it released the prey, which survived. However, a broken mandible suffered by the boa during the incident led to its death by starvation 2 months later. These observations demonstrate that, in addition to improved predator detection and deterrence (i.e., mobbing), active defence against some predators may provide an additional benefit to group living in Coquerel's sifaka, and suggest that predation on group-living primates may be more costly for predators than attacking a solitary species of similar body size.

GENETICS OF WESTERN MASSASAUGAS

E. M. McCluskey and D. Bender [2015, J. Herpetology 49(3): 343-348] note that understanding how habitat heterogeneity influences the genetic structure of populations is an important goal of conservation genetics. Species with different evolutionary histories may respond differently to contemporary habitat loss and fragmentation. Recent genetic analyses have shown high levels of genetic structure in two subspecies of massasauga rattlesnakes of conservation concern (eastern massasaugas, *Sistrurus catenatus catenatus* and desert massasaugas, *Sistrurus catenatus edwardsii*) living in highly fragmented habitats. The authors add to those results an analysis of the genetic structure of the third subspecies (western massasaugas, *Sistrurus catenatus tergeminus*), which has a largely continuous distribution in Kansas but with some isolated populations in Missouri. No evidence was found of genetic structure among the Kansas populations of western massasaugas, though analysis did identify the two Missouri populations as distinct clusters from each other and from the Kansas populations. Population differentiation estimates were much lower across all western massasauga populations compared to those observed in eastern and desert massasaugas. Quantitative analyses of habitat availability and fragmentation confirm that the Kansas landscape is less fragmented than the range occupied by eastern massasaugas; this supports a possible influence of habitat fragmentation on genetic structure of these snakes. The more-continuous distribution and relative genetic uniformity of western massasaugas found in Kansas contrast with the isolated nature of desert and eastern massasaugas, making the western subspecies unique within the massasauga complex.

Unofficial Minutes of the CHS Board Meeting, November 13, 2015

President John Archer called the meeting to order at 7:35 P.M. Board members Dick Buchholz, Rachel Fessler, Ed Huether, and Bran Brookfield Zoo Trip: 45 people signed up, 10 on waiting list. Linda is organizing this.

Shedd Aquarium Trip: Still being worked on. Amphibian exhibit will be there until 2017.

Storage: The space for the trailer has been rented. An inventory of the trailer and Bob Bavirsha's storage unit needs to be done to determine size of a storage unit. on Ottolino were absent.

Officers' Reports

Recording secretary: Minutes from the October 16 board meeting were read and accepted.

Treasurer: Andy reviewed the October financial report. We are substantially in the red due to the lack of a ReptileFest this year.

Membership secretary: Mike Dloogatch read the list of newly expired memberships. Total membership is around 430.

Publications secretary: Aaron LaForge has updated the grants page on the website. He will be getting shows and meetings put up soon.

Sergeant-at-arms: There were 28 people in attendance at the October general meeting.

Committee Reports

Shows:

- Notebaert Nature Museum, first full weekend of each month.
- Travel and Outdoor Expo, Schaumburg Expo Center, January 28–31.

Adoptions: Adoptions: Colleen Schwarz has been very busy, finding homes for several turtles, including an Asian leaf turtle, a wood turtle and 3 box turtles. Also several corn snakes, a ball python and 2 hybrid Florida king/milk snakes.

Junior herpers: 45 attended this month. This was a third anniversary party. The patches have been very popular. December theme is fossorial vs terrestrial animals. Need someone to bring salamanders. February theme is iguanas. A teen who has some will be presenting. Need ideas for the activity table. More kids are participating. Cards with next year's meeting dates are available.

Old Business

ReptileFest: Al's Beef has been confirmed as the caterer.

Midwest Herp Symposium: This year's was last weekend. Mike Dloogatch attended. Erica Mede was a speaker. There were discussions with other societies about how to organize it. Mike will come up with a list of things that need to be done.

Brookfield Zoo tour: There are now 45 people signed up, 10 on waiting list. Linda is organizing this.

Shedd Aquarium Tour: Still being worked on. Amphibian exhibit will be there until 2017.

Storage: The space for the trailer has been rented. An inventory of the trailer and Bob Bavirsha's storage unit needs to be done to determine size storage unit to be rented.

New Business

Elections: Mike Dloogatch has been collecting the absentee ballots. He will conduct the election at the November meeting.

John Archer received an email from a teacher at a special school who received a grant to build enclosures for some animals at the school. Would like to consult with someone from CHS and maybe have students come see set-ups.

Manual of standard operating procedures: The board reviewed the roles of the officers of the society. It was decided that before going on with SOPs the board will go over the bylaws and consider updating them first.

The meeting adjourned at 9:00 P.M.

Respectfully submitted for the recording secretary by Teresa Savino

News and Announcements

HISTORY OF THE HONOLULU ZOO

Long-time CHS member Paul Breese and his wife Jean DeMercer-Breese have written *The Honolulu Zoo: Waikiki's Wildlife Treasure 1915–2015*. Paul is Director Emeritus of the Honolulu Zoo. Whether you're a zoo buff or just an animal lover, you'll find much to enjoy in the collection of old photographs, newspaper clippings and other memorabilia that fills this book from cover to cover. To order or to learn more about the book, visit www.honoluluzoobooks.com.

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UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, December 30, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. **This meeting will be a holiday party.** The CHS will provide soft drinks and snacks. If you would like to bring something edible to share with the group, you are invited to do so. If you would like to bring an animal to show off to the group, you are encouraged to do that as well. This will be a chance to socialize all evening and get to know your fellow members a little better.

The speaker at the January 27 meeting will be **Dr. Matt O'Connor**, staff veterinarian at the Shedd Aquarium. Matt will speak about "The Great Philippine Turtle Rescue." In June of 2015 roughly 4,000 turtles destined for the markets of China were confiscated from a warehouse on the island of Palawan in the Philippines. Nearly all of these turtles were the critically endangered Philippine forest turtle (*Siebenrockiella leytensis*), a species thought to be extinct until it was rediscovered back in 2001. An international effort quickly materialized involving many organizations that brought turtle experts and medical supplies from around the world within a matter of days to respond to the crisis. Matt was one of those able to lend his expertise and assist with the treatment and release of these rare Philippine forest turtles back into the wild. He will share the story of the turtles and results of the international efforts.

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago's newest museum—the **Peggy Notebaert Nature Museum**. This beautiful building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? If so, mark your calendar for the next board meeting, to be held at 7:30 P.M., Friday, January 15, 2016, at the Schaumburg Township District Library, 130 S. Roselle Road, Schaumburg.

The Chicago Turtle Club

The monthly meetings of the Chicago Turtle Club are informal; questions, children and animals are welcome. Meetings normally take place at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Parking is free. For more info visit the group's Facebook page.

ELECTION RESULTS

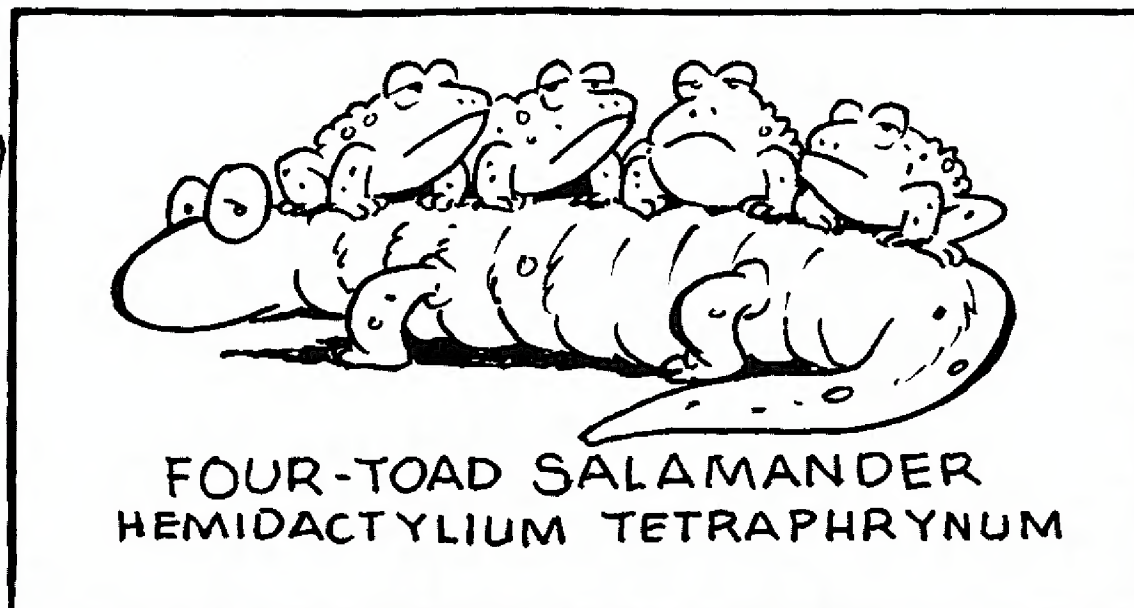
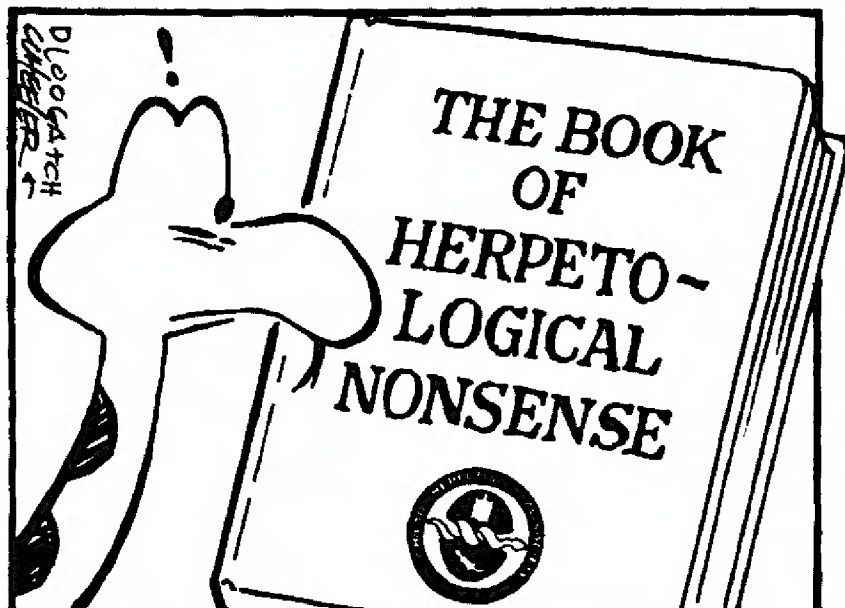
As a result of the elections held November 25, 2015, the following officers and members-at-large will serve on the CHS Board of Directors for the year 2016.

President: John Bellah
Vice-president: Jessica Wadleigh
Treasurer: Amy Sullivan
Recording Secretary: Teresa Savino
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As immediate past-president, John Archer will also serve on the board.

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